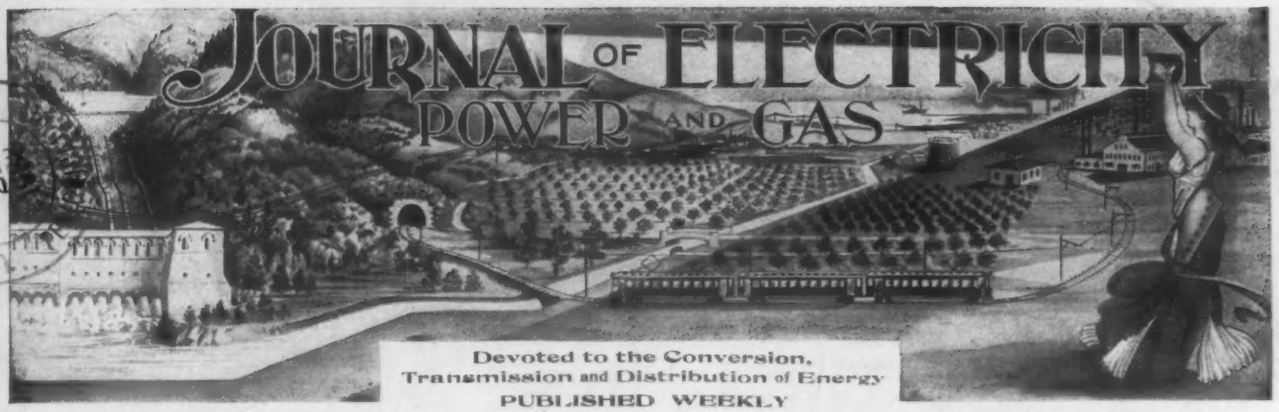

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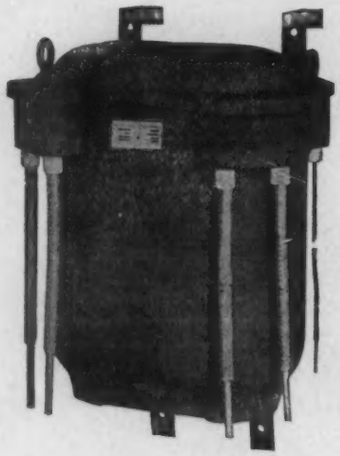

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THE
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Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XX. SAN FRANCISCO, CAL., MAY 16, 1908 No. 20

EVOLUTION OF CAST IRON PIPE.*

Iron and other metals were known to man in prehistoric times. Numerous references in tomb records show early knowledge of gold, silver, copper and lead, if not of iron, used in Egypt to a limited extent even in the predynastic age. Sir Henry Bassemer in 1895 adduced evidence to show that the tools used in the construction of the pyramids must have been made of a meteoric nickel-iron alloy. The theory is however open to considerable doubt in view of the difficulty of working meteoric iron. Indeed, many authorities have denied that meteoric iron is malleable. The hypothesis is nevertheless an attractive one. Probably one of the earliest references to iron is in the record of "Tubal-Cain, an instructor of every artificer in brass and iron," (3874 B. C.) and whose name, by the way, is a bit suggestive to a maker of pipe. As the world progressed, iron is more frequently mentioned; for instance, as tribute received by the Chinese, and as used by the Israelites 2000 to 1500 B. C., and later, in the centuries preceding the Christian era, by the Phœnicians, Greeks and Romans. A fable tells us that Juno was hung from the sky, with iron anvils fastened to her feet, and that Vulcan "fell all day to Lemnos," we do not know how many ages ago. Archæologists have uncovered much to show that the early Egyptians and Assyrians were skilled metal workers, but not as makers of iron pipe.

KNEE AND T JOINTS.
MADE ABOUT 4,000 B. C. FOUND IN THE EXCAVATIONS OF THE TEMPLE OF BEL, NIPPUR, BABYLONIA.

EARLIEST PIPE.

In the excavations of the Temple of Bel, at Nippur, Babylonia, Prof. Hilprecht found clay pipe, which from their location must date from more than four thousand years B. C. He tells us "directly beneath the ancient enclosing wall opened a vault about 1 m. high, built in the form of an arch. It belongs without doubt to the fifth millennium. * * * In the 'Kingdom of Nimrod' it was not necessary to tear up the pavements whenever an underground pipe burst, for this structure is not a mere subterranean canal for drainage, but an arched passage, in the bottom of which are imbedded in cement, * * * two clay pipes of about 15 c. m. diameter, alongside each other. If one of them burst, a workman crept into the vault and repaired the damage without further difficulty. * * * About 500 knee and T joints found in the vicinity show us that even at that early time they understood how to unite pipe meeting at right angles." Here we have reference to the earliest known Babylonian arch, and undoubtedly to the earliest pipe and specials known to us to-day. From the fact that such pipe and specials were used at that time, it would seem probable that the expert metal workers of those early days soon supplemented clay pipe with pipe of lead, and even of copper or brass for important services. We read of "cast pillars of brass" and molten brass," as early as 1000 B. C. We know that the Greeks and Romans used lead pipe extensively, but the knowledge of how to make such pipe probably came down to them from the Phœnicians or Egyptians of earlier times. The Delhi Laht, or huge iron pillar, and iron beams used in the construction of temples and palaces in India, and massive iron girders found in ruins at Rome, testify to the existence, several centuries B. C., (though the Laht may be of a later period) of great iron works in India and in Spain. Their product seems to have been entirely of wrought iron and steel, but apparently did not include pipe. Among the bloomeries of early times we do not find any with a pipe foundry annex. Iron castings or rather "fused iron forms," Aristotle (359 B. C.) tells us, were not then commercially made, and indeed until five or six centuries ago were apparently scarcely known at all. In these days of iron and steel, with all our hurry and pressing demands, we seldom stop to think of the wonders wrought two, three and even four thousand years before Christ, or to credit the civilization and culture of the people of those far away days, with certain influences felt to-day.

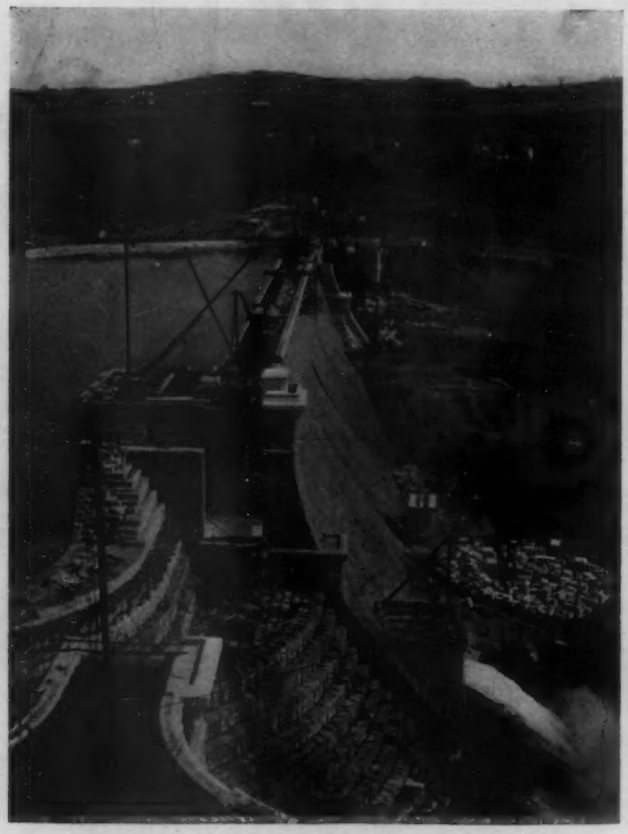
AN OLD ROMAN AQUEDUCT.

WATER SUPPLY CONDUITS.

Probably the earliest artificial conduits were the canals and other surface waterways of comparatively level ancient Egypt and Babylonia. Some of them were large undertakings, but especially in Egypt were constructed with a view mainly to irrigation and also for navigation, rather than as conduits of water for domestic supply. The early Egyptians were famous for their dams, dikes and canals, and for their ingenious

*Contributed by R. W. Martindale.

though primitive methods of raising water. They made brick and built treasure cities, and, as suggested, probably made pipe of baked clay, but we read of wells and water jars rather than of pipe. Memphis and Thebes had the Nile, but what of the distribution of their domestic water supply? Glancing farther east, on the site of old Jericho may be traced several conduits and a reservoir. Damascus, that city without a known date, early had its conduits. At Jerusalem, about 1000 B. C., King Solomon built aqueducts. We also read that the good King Hezekiah, 717 B. C., "made a pool and a conduit and brought water into the city." According to Dr. Bertholet of the University of Basle, this is now confirmed by an old manuscript of that period, recently discovered, which translated, reads: "Hezekiah fortified his city by bringing water thereto, and he bored through the solid rock by means of bronze, and he collected the water in a reservoir;" no mention is made of pipe. Within the past few years the tunnel has been identified, and pick marks indicate it was bored from both ends—



CROTON DAM NEARING COMPLETION, 1905.

an interesting bit of early engineering. Babylon (about 580 B. C.) had its great reservoir, canals and hanging gardens, but we find little to indicate how the water was distributed. Probably even earlier was built the great aqueduct at Carthage, some fifty miles in length. Its route may be partly traced to-day but the history of Carthage, like that of most cities of the time, lacks definiteness as to water supply distribution. Water brought by these conduits to these ancient cities must have been more or less distributed to public pools and fountains, and probably to important buildings, palaces and temples, and as the world progressed, clay and lead pipe were more freely availed of. Thus we read that about 600 B. C. the Greeks were building waterworks, using for distribution clay and lead pipe.

The Romans, too, had famous aqueducts; Rome some fourteen of them, aggregating about 359 miles in length, of which 304 were underground conduits, and 55 above ground. The Aqua Appia dates from the time of the Censor Appius Cœcus Claudius (312-304 B. C.) The others seem to have been constructed in the intervening period up to around the beginning of the Christian era. The two largest, Claudia and Anio Novus, 45 and 62 miles in length respectively, were built in 38 to 48 A. D. Their routes joined about six miles from Rome and thence there were two separate channels, one above the other, supported on arches, which at one point rise 100 feet in height.

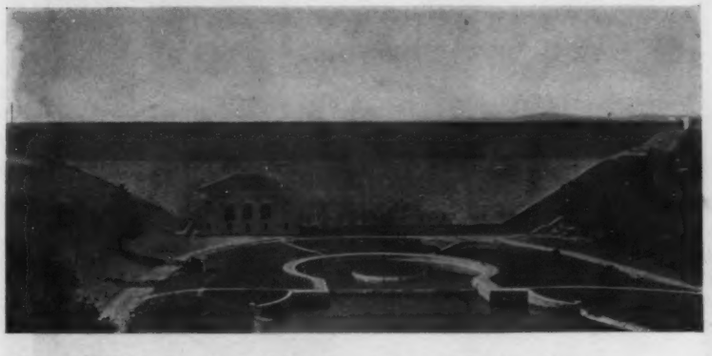
LEAD PIPE. Of the Aqua Virgo it is recorded, "the water was conveyed in pipe, partly under and partly above ground, on a solid substructure or on arches." This reference to pipe is probably to lead pipe, which were evidently preferred for lines under more or less pressure, for lead pipe were used in "crossing valleys," "laid according to the slope of the hill," down to "a long level, then up," with intermediate standpipe or venters. According to Vitruvius (about 25 B. C.,) such lead pipe was made "in lengths of not less than 10 feet," and "take the names of their sizes from the quantity of the inches in the width of the sheets before they are bent around; thus, if the sheet be 50 inches wide before bending into a pipe, it is called a 50-inch pipe; and so of the rest." Vitruvius gives a list of ten sizes ranging from 100 inches, weighing 1,200 pounds, to 5 inches wide weighing 60 pounds per length. The pipe were probably soldered with an alloy of lead and tin. Lead pipe were also used for distribution, as to some extent were clay pipe "tongued at one end." The aqueducts supplied the baths and numerous large public fountains, from which last the people obtained their water, except such as could afford to pay for a separate pipe to their houses, and these latter were a source of considerable revenue. Vitruvius also notes injurious results from the use of lead pipe, adding "water should therefore on no account be conducted in lead pipe, if we are desirous that it should be wholesome." The excavations at Pompeii, which were destroyed by the great eruption of Vesuvius, 79 A. D. have revealed numerous fountains, and two thermæ or

GATE HOUSE AND RESERVOIR CONNECTIONS.

public baths which were supplied with water through lead pipe from reservoirs much as were the famous baths at Caracalla and other thermæ in Rome. Lead pipe as used by the Greeks and Romans were common enough in those days and probably for several centuries preceding the Christian era but we find no mention of iron pipe.

AQUEDUCTS. The term "aqueduct" was applied to the conduit as a whole, comparatively a small portion of which was carried on the arched masonry structures we are prone to think of as aqueducts, and it is interesting to note how at that early period these waterways were built so much of their length underground: Their grades (Vitruvius suggests "a fall of not less than one half a foot to a length of one hundred") were so adjusted that the water flowed by gravity without undue velocity, as much in vented tunnels or conduits as possible, and thus often wide detours were made. For instance, the Aqua Claudia starts at a point thirty-five miles from Rome, and winds its way, a distance of forty-five miles, to the city. The conduits were lined with some material impervious to water, and in section varied with

location. Tunnels were ventilated by vertical shafts, and usually the valleys were crossed with arched structures. To some extent the Romans may have copied the Greeks, who apparently did not use the arched masonry aqueduct, at least until much later, but carried their vented conduits through hills into valleys under streams and, to supply Syracuse, even under the sea. Considering the material available these underground conduits are remarkable, and as some must have been under considerable pressure it is probable early Greek engineers had "troubles of their own" causing the Romans to adopt the arched masonry aqueduct. On the other hand, possibly Greek engineers were not then well versed in arch building. Be this as it may, it is hard to realize that anything with which we are so familar as the arch, or water works, or even cast iron pipe, were at any time novelties and really had their day of invention and introduction. There is no telling what early Greek and Roman engineers would have done could they have had cast iron pipe as we have them. That in those far off days they were able to accomplish so much is surprising, and it must have cost much in labor and patience. Think of driving a tunnel through rock without the appliances we have available today; and yet the water supply of Athens was obtained through three underground conduits mainly cut through rock, two of them passing under the bed of the river Illissus. These brought water to a reservoir outside the city from which it was distributed in underground channels of various forms and partly through pipe of baked clay and through lead pipe. Thus Athens early enjoyed its baths, fountains and public water supply, but the quite wonderful aqueducts of the Romans, and those later built in France and other countries, are the most notable monuments to early water works engineers. One of the most beautiful later structures, dating from the seventh or eighth century, is the aqueduct Dalle Torre, near Spoleto, Italy, with its ten graceful pointed arches of 66 feet span, and nearly 300 feet in height, and which, restored, is in use today. Paris, London and Vienna, reaching back into the Roman period, and Berlin and other cities of more recent date, have each included in their development various water supply problems. Aqueducts, conduits, cisterns, reservoirs and fountains, with clay and lead pipe, (and later bored logs) seem to have been in general use and in the early days of Athens and of Rome we read of much that is interesting and curious, but we must pass over these intervening centuries to the time we first hear of cast iron pipe.



WACHUSETT RESERVOIR DAM, 217 FEET HIGH.

MASONRY AQUEDUCT ON LINE FROM WACHUSETT RESERVOIR.

CASTINGS OF IRON. Not until the fourteenth or the fifteenth and sixteenth centuries are castings of iron really mentioned. In the latter, cast iron cannon was made. Naturally not long afterward cast iron pipe were produced and we hear of it early in the seventeenth century. In 1720 it was said "there is not a street in London but water runs through it in pipe, conveyed underground," and while the kind of pipe is not specified, they were probably, in part, of cast iron, as such pipe had been used in France in the preceding century. Since 1700 we find their use constantly increasing and in the last century they played an important part in the makeup of most conduits and aqueducts, to say nothing of mains for distribution.

MODERN CONDUITS AND RESERVOIRS WITH CAST IRON PIPE. The canal, with its forty-five tunnels and numerous aqueducts, which brings water some sixty miles to supply Marseilles, and the Old Croton Aqueduct, with its conduits, tunnels and splendid stone arched bridge carrying cast iron pipe over the Harlem River, and which conveys water some thirty-four miles to New York, are examples of comparatively modern aqueducts, both having been completed about 1842. Since then the development of the Croton water supply has gone on apace, with its well-known reservoirs, conduits and piping; one set of the latter comprises eight lines of 48-inch cast iron bell and spigot pipe laid in one trench, which lead from the 135th Street Gate House. Here also terminates the new Croton Aqueduct, completed in 1890, which is nearly thirty-one miles long, almost entirely in deep rock tunnels, only a little over a mile being in trench or on embankment. The new Croton dam, now completed, is the highest and largest reservoir dam in the world, and contains 850,000 cubic yards of masonry. The new Croton reservoir is nearly twenty miles long, and there are nearly seventy-five miles of stone walls surrounding the land required for it. When full, the old Croton dam about three miles above will be submerged to a depth of 34 feet, and the reservoir will contain about 38 billion gallons. This, with the other reservoirs of the Croton watershed, will afford an available capacity of 72 billion gallons, which is barely sufficient for present needs. The proposed new supply for Greater New York, recently authorized, (1905) will be taken from Esopus Creek in Ulster County, New York, about ninety miles north of the city, requiring the crossing of the Hudson River by the proposed 500 million gallon tunnel and trench aqueduct. The works will include a 66 billion gallon reservoir with a masonry dam, 1,280 feet long and 175 feet high from creek bed, contract for which was recently let.

As we look over the more recent undertakings we find cast iron pipe becoming more and more of a factor, as used for gate houses, reservoir connections, for siphons in crossing valleys, and for supply mains. The new water supply at Manchester, England, for instance, comes largely from the beautiful Lake Thirlmere, a distance of some ninety-six miles, through a modern conduit partly in tunnels and cut and cover channels, while it dips into valleys and under streams by means of inverted siphons of several lines of 48-inch, 42-inch and 36-inch cast iron pipe some of them subject to a pressure due to more than 400 feet head. Another recent achievement in Scotland is the completion, in September, 1905, of the new water supply for Edinburgh. The water is brought some thirty-six miles from Talla in the parish of Tweedsmuir, Peebleshire. The conduit is composed of 23 miles of built tunnel, cut and cover aqueduct, with six siphons each of several lines of 36-inch to 27-inch cast iron pipe, in all 13 miles of line in piping, and the new plant includes a reservoir which when full will contain more than 2½ billion gallons.

Perhaps the most notable of recent water supply undertakings in the United States is that of the Metropolitan Water and Sewerage Board of Massachusetts, at Boston. This comprises the great Wachusett Reservoir, now finished, covering 7,200 acres, with a capacity of 63 billion gallons, with its massive dam 217 feet in height, containing 280,000 cubic yards of masonry and which, with the late Cochituate and eight reservoirs on the Sudbury River,

is calculated to be capable of supplying 173,000,000 gallons per day to the nineteen municipalities comprising the Metropolitan Water District. Water is conveyed from the reservoirs to this district, distances of from fifteen to thirty miles, through the Cochituate, Sudbury, Wachusett and Weston Aqueducts the two latter having each a daily capacity of 3 million gallons. These aqueducts are, in general, constructed of masonry covered by earth embankments, but there are 6.6 miles of tunnels, and in several instances the aqueducts cross valleys on masonry arches or by means of pipe siphons.* Water delivered by the aqueducts is distributed to the several cities and towns comprising the Metropolitan Water District by means of 84 miles of cast iron pipe 34 miles of which are 48 inches and 60 inches in diameter.

DOUBLE 60-INCH LINE TO RESERVOIR. METROPOLITAN WATER DISTRICT, SPOT POND.

Connected with the distribution system of the several municipalities, there are in addition 1,423 miles of cast iron pipe in sizes from 4 inches to 48 inches. Several of the pipe lines are carried under navigable streams, requiring the use of pipe with flexible joints, the use of coffer dams, or other special methods of pipe laying.†

FOUR LINES OF 60-INCH CAST IRON PIPE. ONE 48-INCH AND ONE 30-INCH SHIFTED TO LEFT.

The present consumption of water in the district supplied, is about 117 million gallons per day, equivalent to 120 gallons per inhabitant. About 25 per cent. of this quantity is delivered by gravity, the remainder being pumped at pumping stations located at the Chestnut Hill Reservoir about five miles from the State House. These stations contain modern pumping engines of the highest efficiency, capable of pumping 171 million gallons of water per day.

Within the limits of the Metropolitan District, which in general includes the cities and towns within ten miles of the State House, there are several distributing reservoirs, the largest of which, Spot Pond, has a capacity of one billion eight hundred million gallons, and is 163 feet above Boston city base, which is substantially low water mark in Boston Harbor. The water supplied to each municipality is measured by means of Venturi meters placed on the connections between the Metropolitan pipe and the pipe of the several cities and towns, fifty-three meters being used for this purpose.

LAYING THREE LINES OF 60-INCH PIPE UNDER CHARLES RIVER, BOSTON, USING COFFER DAM.

60-INCH ROSEMARY SIPHON WELLESLEY, MASS.

The board having charge of the Metropolitan Water Supply, also has charge of the Metropolitan Sewerage Works, and in connection with these works has recently completed the construction of new works for the disposal of a portion of the sewage of the district. In the portion of the system recently built, the sewage is discharged into the ocean through two lines of 60-inch cast iron pipe each extending about a mile from the shore.

* For this purpose cast iron bell and spigot pipe in sizes up to 84 inches inclusive may now be had.

† Some of these are referred to in late installments under "Submerged Piping."

At Philadelphia, the recently completed Torresdale conduit or tunnel which conveys water from the Torresdale filter beds to the Lardner's Point pumping station, is worthy of mention. Here again 60-inch cast iron bell and spigot pipe play an important part in forming the force mains from these pumping stations to Frankford Creek, where the water is delivered to the distribution system, working against a 48-inch relief line to Oak Lane Reservoir. In a recent report by a board of expert engineers, it is suggested that the use of 60-inch cast iron pipe instead of the masonry conduit from filters to pumping station would have been cheaper and preferable. Four lines of 60-inch cast iron pipe lead from the Lardner's Point pumping stations, and were put down after two lines of cast iron piping, 48-inch and 30-inch diameters, under water pressure, had been moved to one side. Some two blocks from the pumping station, three lines of the 60-inch cast iron force mains are led off toward Frankford Creek. The photograph shows a section of these 60-inch force mains as tested in the open trench, when they were subjected to a pressure of 200 pounds for five hours.

We have now had a hurried look at some of the waterways and works of earlier times and a closer view of some modern plants. Thus we see engineers using and depending more and more on cast iron pipe, and they are to-day a most important factor in the development of modern water supply. Cast iron pipe have completely changed earlier methods, and made possible the widely extended distribution of water, to say nothing of their use for gas and other well known purposes.

(*To be continued.*)

TIMBER OWNERS ORGANIZE TO FIGHT FIRE.

One of the most important economic movements of the day about which the general public has yet learned little is the concerted action of owners of timber in different parts of the country in organizing associations to protect their holdings from fire. In the Pacific Northwest, the Washington Forest Fire Association has just elected officers at Seattle and begun work for the year with 3,000,000 acres under its care. The plans include a system of patrol by rangers resembling the work done by the United States Forest Service in guarding against and extinguishing fires.

Organizations of similar kind and for a like purpose are at work in Oregon and Idaho. In the latter State, a portion of the expense is borne by taxation and paid from the State Treasury. A western railroad company which holds large tracts of timber has taken steps to guard its property from fire, and during the short time that its plans have been in operation, it has met with most encouraging success.

Similar work is being done on the other side of the continent. Forest owners in Maine have gone to work in the same systematic way to control the forests' great enemy, Fire. Like organizations are found in other parts of the country, showing how fully it is now realized that protection against fire is of the greatest importance.

It is safe to say that fires in this country have destroyed more timber than lumbermen have cut. When timber was abundant, the waste passed almost unnoticed, but now that a scarcity is at hand and an actual wood famine threatens in the near future, the owners of forest lands are waking up and taking action to save what is left.

CALCULATIONS FOR POWER PLANTS.*

By Dr. Franz H. Hirschland.

Every manufacturer of chemical, mechanical or any other goods has to make himself familiar with the kind of power and power generation which he wants to use in his factory. The success of an enterprise depends, to a great extent, on the price of power. The decision on the location of a plant is not merely influenced by railway connections, source of raw materials, points where to deliver the goods, labor questions, etc., but also to a great extent by the power question. Especially important, of course, is this question in electro-chemical enterprises where power is the greatest expense.

To solve the question which kind of power and which kind of power generation is the best and most advantageous one, in a general way, is an impossible task. The items, which have to be considered on answering such a question, change from case to case, and depend not only on the size of the power house, the number of hours which the machines have to run, but also on the voltage which may be required and many other points.

To give a scheme how the power generation question can be solved from case to case, one example is taken in the following and a comparison is set between.

1. Steam.
2. Gas.
3. Hydro-electric power.

It is presumed that a power house of 800 kilowatts, delivering 6,200,000 kilowatt-hours per year, is used for an electro-chemical process. The plant having to run about 24 hours per day makes it necessary to devote special consideration to the spare engines.

To give a comparison between the different kinds of power generation, the utility of a plant in a general way, the price of the plant and the price of the current at the switchboard have to be compared.

I. Steam Power.

In deciding on a steam-power plant, there is the choice of either steam engines or turbines. With regard to the expenses of the plant and economy of the same, both plants are about equally good, but it has to be considered that the high speed of the turbines combined with the low voltage of the dynamo machines required for electrolytical purposes makes the use of the turbine less advantageous.

Should steam also be required for heating and melting purposes, as it is often the case in electrolytical processes, this can be easier done from a steam engine than from a turbine. With steam engines it is possible to take steam either out of the receiver between high and low pressure cylinder, or to let one of the steam engines run without condenser, the same working with a certain counter pressure. With steam turbines, the same solution would materially affect the economy of the plant.

There being no great difference in price, space and equipment between steam engines and turbines of the required size, the choice remains more a matter of personal taste than of technical advantages.

A condensing plant can be considered in most cases to be economical, at least if a factory site can be located in such a way that there is a sufficient amount of cooling water.

The use of superheated steam for the steam engines would scarcely bring any advantages, as the valves of the Corliss engines, which are most extensively used in this country, would have a tendency to bind. With turbines, on the other hand, the use of superheated steam would have to be very seriously considered.

For both cases a steam pressure of 150 pounds and a vacuum of 26 inches would meet the local requirements.

*Electro-chemical and Metallurgical Industry.

Assuming the above-mentioned points, the **price of an electrical power station** of 800 kilowatts, driven by a steam plant, would be, approximately, as follows:

Factory site	$ .....
Building with stack	28,000
Steam generators	20,000
Foundation	2,000
D. C. dynamos with switchboard, complete	24,000
Steam boilers, including brickwork, complete	16,000
Condenser, complete	2,000
Pumps, feed-water heater	2,500
Piping, complete	6,000
Traveling, crane	6,000
Freight (?)	2,000
Erection of all machinery	6,000
Total cost of installation	$114,500

The consumption of steam for a plant would be about 14 pounds per 1 horsepower-hour, or about 25 pounds per kilowatt-hour at the switchboard, in which latter amount the consumption of the auxiliaries is included. With an evaporation of 8 pounds of steam with 1 pound of coal of 13,000 to 14,000 B. T. U., 1 kilowatt-hour can be generated with 3 pounds of coal.

The **price of current at the switchboard** is composed as follows:

1. Depreciation and interest—

According to local usage the depreciation and interest, including repairs and insurance, can be put at 14 per cent of the capital amount, which makes per year $16,000

2. The operating expenses are divided into—

A—Labor.

One would require, assuming two shifts, ten men earning per year about 7,400

B—Fuel.

For the generating of 6,200,000 kilowatt-hours, at 3 pounds of coal per kilowatt-hour, 9,300 net tons of coal will be required per year. The different kinds of coal, which can be used for steam boilers, vary greatly in price according to the distance from the mine. Near the mines themselves, this coal can be obtained for about $1.25 per ton. Using this lowest figure to calculate on, the coal price would bring up the expenses for this item per year to 11,600

C—Petty Expenses.

Lubricating oil being the principal factor, this expense can be put down at a yearly figure of about 4,000

Drawing all these different expenses together, one finds that with a price of $1.25 per ton for coal the expenses for the generating of 6,200,000 kilowatt-hours during the year are, approximately $39,000

The price for 1 kilowatt-year is therefore $55.20.

II. Gas Power.

The gas engine has in the last few years awakened great interest all over the world.

First-class machine factories have begun the building of these engines, and many special factories already exist which make nothing but producers.

A large field has also been opened for the combustion engine on account of the large available supplies of natural gas. The oil engine is also extensively used for certain purposes.

A—Producer Gas Plant.

Producer gas plants are made both for anthracite and bituminous coal. For soft coal the plants become more difficult to serve, and the cleaning of the same is awkward. The price for such a plant is also several thousand dollars higher than for the same with anthracite. The safety factor and economy are in both plants roughly the same. The choice of one or the other can only depend upon the price of coal. Where both sorts of coal are equal in price there could be no hesitation in choosing anthracite.

All firms guarantee 80 per cent efficiency for their producers; that means they can obtain from 1 pound of coal of 13,500 British Thermal Units an amount of gas with 10,500 British Thermal Units. The caloric value of producer gas ranges between 125 and 150 British Thermal Units per cubic foot.

The **cost of an electrical power station** of 800 kilowatts, with a producer plant using anthracite coal, would then be as follows:

Factory site	$ .....
Building	23,000
Gas engines	55,500
Foundation	7,500
D. C. dynamos with switchboard, complete	24,000
Gas producers	21,000
Foundation	6,000
Compressed air starting apparatus	2,000
Water pumps with electric motor	1,000
Piping, complete	4,500
Traveling crane	6,000
Freight (?)	2,000
Erection of all machinery	7,500
Total cost of installation	$160,000

The price of a similar plant for soft coal would be about $165,000, the higher price being explained by the more expensive producer.

The consumption of coal in a producer plant shows the same to be very economical. The gas engine generates with about 10,500 British Thermal Units—one braked horsepower-hour. With an efficiency of the producers of 80 per cent and coal of 13,500 British Thermal Units, one comes to the result that 1 pound of coal produces one braked horsepower-hour.

One pound per braked horsepower-hour is the claim which all gas-engine manufacturers bring against their competitors in the steam-engine branch, meaning thereby either a good, soft coal, the size of which is not especially important (as the same binds, anyhow), or an anthracite coal of at least No. 1 buckwheat size; that means a coal which is sieved through netting 9/16 inch diameter. One can safely reckon upon the consumption of 1.9 pounds per kilowatt-hour at the switchboard, including all losses and the auxiliaries.

The **price of current at the switchboard** would be as follows:

1. Depreciation and interest—

14 per cent of $160,000 ..... $22,400

2. Operating expenses—

A—Labor.

Ten men 7,400

B—Fuel.

1.9 pounds per kilowatt-hour, therefore, for 6,200,000 kilowatt-hours, 5,900 tons, at the price of $1.25 7,400

C—Petty Expenses.

(More and better quality of lubricating oil used than with steam engine) 5,000

With coal at $1.25 per ton, the entire expenses for generating 6,200,000 kilowatt-hours per year come to .. $42,200

The **price of 1 kilowatt-year is therefore $59.60.**

The depreciation and interest on gas engines being higher than on steam engines, the consumption of fuel on the other hand, higher with steam engines, gives one a certain coal price at which the generating expenses of both plants are equal.

In the above-mentioned cases this would be at a coal price of $2.18 per ton. If the price of coal is cheaper than this figure the steam engine plant is more economical; with higher prices of coal the gas engine plant is cheaper.

When having to pay a price of $3.00 per ton for coal, as, for instance, in New York and Jersey City, the price of current for gas engine plant would be about $67.20 **per kilowatt year,** and for steam engine about $73.00 **per kilowatt-year.**

In regard to safety and simplicity of regulation, both plants would be about equally good. The fact that one can over-load a steam engine very much more than a gas engine, is not so important in an electrolytic plant on account of the current consumption being particularly constant.

B—Natural Gas Plant.

Natural gas, which is especially well suited for gas engines, is to be had in the States of Pennsylvania and West Virginia. It has a very high caloric value, which can be placed at about 1,000 British Thermal Units per cubic foot.

The **price of such a plant** would be, approximately, as follows:

Factory site	$.....
Building	9,000
Gas Engines	52,000
Foundation	7,000
D. C. dynamos with switchboard, complete	24,000
Compressed air starting apparatus	2,000
Water pump with electric motor	1,000
Piping, complete	6,000
Traveling crane	6,000
Freight (?)	1,500
Erection of all machinery	7,000
Total cost of installation	$115,500

The consumption of natural gas in a gas engine which can generate 1 horse-power-hour out of 10,500 British Thermal Units would be 10.5 cubic feet per braked horse-power-hour, calculating upon 1,000 British Thermal Units per cubic foot. With all losses and reckoning the auxiliaries, the consumption would then be about 18 cubic feet per kilowatt-hour at the switchboard.

The **price of the current at the switchboard** would then be as follows:

1. Depreciation and interest—
14 per cent at $115,500 ..... $16,200
2. Operating expenses—

A—Labor.

Six men 4,700

B—Fuel.

The consumption for 6,200,000 kilowatt-hours at 18 cubic feet per kilowatt-hour is equal to 112,000,000 cubic feet per year. The price varies in the different cities from 4 cents to 20 cents per 1,000 cubic feet. Assuming a price of 4 cents per 1,000 cubic feet, the expense for fuel would be per year 4,480

C—Petty Expenses.

(Lubricating oil, etc.) 5,000

Total expense, therefore, for the generating of 6,200,000 kilowatt-hours per year with natural gas, at a price of 4 cents per 1,000 cubic feet, would then be $30,380

The price of 1 kilowatt-year is $42.90.

This price is comparatively low. The engine can also be considered as perfectly reliable. The only question is whether the flow of gas can be entirely relied upon or not. The difficulties which arise therefrom can be partially overcome by placing the plant as near to the natural gas well as possible, as the flow of gas is mostly disturbed through breakage and repairing of the gas pipes. In many parts of West Virginia the gas wells are considered to be inexhaustible, and especially so in Clarksburg and Fairmont, where gas at a price of 4 cents per 1,000 cubic feet can be obtained, and which cities are situated in the midst of great bituminous coal mines. At all events, it is advisable to consider the possibility of a failure, or at least a reduction of the pressure in the supply of natural gas, and it should be stated at this point that the alteration of a plant for natural gas into a producer plant is, under all circumstances, feasible.

Producer gas having a much smaller caloric value than natural gas, will make it necessary, in converting one plant into the other, to make certain alterations in the engines. The simplest method would be to alter either the mixing valves for gas and air or the compression. In this case the output of the machines would be reduced by about 20 per cent on account of the low caloric value of the gases. The dynamo machines would also be not used to their full load, and one would therefore require a new unit in order to attain the same current as formerly.

For this reason many firms recommend the use of new cylinders, retaining the frame, fly-wheel and all other parts, though some manufacturers think that the same effect could be reached by reboring the cylinder to 1 inch more in diameter and using new pistons.

C—Oil Plant.

For small plants, or in places where there is little room available, the oil engines can be used with advantage, especially as one saves the space necessary for a producer or boiler. Up to now, engines have not been built for more than a 150-kilowatt, so that for this special case one would require 7 units, counting in two spare engines.

The **price of such a plant** would be approximately as follows:

Factory site	$.....
Building	14,000
Seven oil engines	104,300
Foundation	8,000
Seven D. C. dynamos with switchboard, complete	28,350
Compressed air starting apparatus	2,000
Water pumps with electric motor	1,000
Piping, complete	5,350
Traveling crane	6,000
Freight (?)	2,000
Erection of all machinery	10,000
Total cost of installation	$181,000

The oil consumption would be 1 pound per braked horse-power-hour, which comes to about 1.6 pounds per kilowatt-hour at the switchboard, all losses and auxiliary machinery included.

The **price of the current at the switchboard** would then be as follows:

1. Depreciation and interest—
14 per cent of $181,000 ..... $25,300
2. Operating expenses—

A—Labor.

Six men 4,700

B—Fuel.

The consumption of 1.6 pounds, or 0.21 gallon per kilowatt-hour would be for 6,200,000 kilowatt hours per year, 1,300,000 gallons, costing with the price of oil at 2 cents per gallon 26,000

C—Petty Expenses.

(Lubricating oil) 5,000

The total expenses for 6,200,000 kilowatt-hours per year with an oil-engine plant would be, with oil at 2 cents per gallon, about $61,000

TABLE SHOWING COMPARATIVE RESULTS.

	Steam	Producer Gas.	Natural Gas.	Oil.	Hydro-Electric
Total cost of installation	$114,500	$160,000	$115,500	$181,000	$40,800
OUTPUT IN KW-HOURS PER YEAR 6,200,000					
Fuel or energy required for 1 kw-hour at switchboard	3 lbs. of coal.	1.9 lbs. of coal.	18 cu. ft. of gas.	0.21 gal. of oil.	1.54 hp-hour
Lowest obtainable price of fuel or energy	$1.25 per ton.	$1.25 per ton.	$0.04 per 1000 cu. ft.	$0.02 per gal.	$16 per 1 hp-year.
Fuel cost or energy cost per year	11,600	7,400	4,480	26,000	17,600
Labor per year	7,400	7,400	4,700	4,700	1,600
Petty expenses per year	4,000	5,000	5,000	5,000	1,000
Depreciation and interest per year	16,000	22,400	16,200	25,300	5,700
Total cost of current at switchboard (6,200,000 kw-hours)	39,000	42,200	30,380	61,000	25,900
Cost of current per kw-year	55.20	59.60	42.90	86.00	36.60
Comparative cost of current with electricity at 100	151	163	117	235	100

The price per 1 kilowatt-year would therefore be $86.00.

This price per kilowatt-year, calculating upon an oil price near the points of production, is so high that the use of the oil engine cannot be considered in this problem, especially as the price of the oil in the East is double that quoted.

III. Hydroelectric Power.

Though the direct use of turbines and water power is uneconomical in very small plants, the same becomes a most important factor if it is worked on a large scale, as, for instance, at Niagara Falls. In the big turbine plants very high voltage alternating current is generated, which is especially adaptable to the transmission of energy.

For our purpose it would therefore be necessary to transform the alternating current into a direct current of 150 to 200 volts. A rotary converter would be the simplest method of solving this problem, but in consideration of the great difference in voltage on both sides of the machine it will be better in this case to use a motor generator. This plant shall consist of 2 units, as a spare unit may not be needed in such a simple plant.

The approximate **price of such a plant** would then be as follows:

Factory site	$.....
Building	7,000
Motor generators with switchboard, complete.	30,000
Foundation	1,400
Freight (?)	400
Erection of all machinery	2,000
Total cost of installation	$40,800

The efficiency of the plant could be taken at about 0.87.

The price of the current at the switchboard would then be as follows:

1. Depreciation and interest—

14 per cent of $40,800 ..... $ 5,700

2. Operating expenses—

A—Labor.

Two men 1,600

B—Current Consumption.

The lowest price of 1 horse-power-year, which may be offered at the present time, is $16.00; 6,200,000 kilowatts per year, or 1,100 horse-power-year, will represent 17,600

C—Petty Expenses.

(Lubricating oil, etc.) 1,000

Total expense, therefore, for a plant of 6,200,000 kilowatt-hours per year, at a price of $16.00 per horse-power-year, would then be $25,900

The price for 1 kilowatt-year would, therefore, be $36.00.

SPLICING LEAD-ARMORED CABLES.*

H. H. Brown

There is no link in an electric system more reliable then lead-armored underground cables, yet more unreliable if improperly installed. Hundreds of miles of cable are operating at voltages up to 15,000, and actually show better results, as regards continuity of service, than the best aerial construction.

The weakest point in all cable lines are splices, and it is here that breakdowns usually occur. For this reason cable-splicing requires the exercise of the utmost skill, and it is a trade within itself. No description can supply this skill and experience, but the writer believes that a brief description of the methods followed by the San Francisco Gas and Electric Company, which he believes represents the best practice, will be both interesting and instructive.

In the following description, multiple conductor, or "multiplex" cables, to operate at 6,600 volts or over, will be assumed. The same general method and precautions apply to single conductor, or "simplex" cables, and cables to operate at lower voltages.

A splicing crew consists of a splicer and one helper. The splicer must be a skillful workman, who has learned his trade thoroughly by serving an apprenticeship as helper. The crew is supplied with the following tools:

Wheelbarrow.	Chipping knife.
Tool box.	Insulating knife.
Plumber's furnace.	Large ladle.
Large melting pot.	Small ladle.
Small melting pot.	Soldering iron.
Large coffee pot for boiling "ozite."	Hack saw.
	Monkey wrench.
Small coffee pot.	Stilsen wrench.
Catch pan.	Screwdriver.
Two small funnels.	Plyers.
Lead dresser.	Dog tent (during rainy weather.)
Scoring tool.	
Gorge tool.	

In addition, the following materials are supplied:

Wiping lead.	Paper tape.
Stick solder.	Pure rubber tape.
"Ozite" insulating compound.	Soldering flux.
	Copper connections.
Tallow candles.	Waste.
Pasters.	

Cables are commonly left by the "pulling gangs" with two or three feet of extra length in each manhole. This is to allow for proper placing upon supports around the side of the hole, and the further reason that the first one or two feet of the cable, particularly after a hard pull, is liable to be crushed by the pulling clutch, and therefore unreliable and must be discarded.

*California Journal of Technology.

Upon entering the manhole, the splicer first places protectors of lead around the cable at the point where it enters each duct line. The protectors are commonly made of old pieces of lead armor, beaten into shape. As a further temporary protection, the mouth of the duct should be thoroughly packed with waste, particularly under the cable. Next to the joints, the most prolific source of trouble in cable lines are the points of entrance to the manholes, as it is here that short bends or buckles are liable to occur. Short bends are to be avoided *absolutely*.

The splicer next examines the cable carefully for signs of mechanical injury, that he may plan his splice to cover such injured point, if there be any. The position of the splice is then carefully determined so as to rest finally between two supports upon the side of the manhole, where it will be subjected to no mechanical strain. Joints must be carefully supported on each side, and no portion of the weight of the cable, or bending strain, be allowed to come upon them. In the following description we will assume that the cable has been found free from injury and that we can place our supports at will. These supports commonly consist of pieces of ½-inch gas pipe cemented into the manhole sides, and spaced about two feet apart.

The injured ends of the cable are then cut off, care being exercised to cut as little as possible, and the cables tested for moisture. Slight imperfections in the sealed ends often admit moisture to the interior, particularly if the weather be rainy or the manhole damp. This is best accomplished by dipping the exposed end of the cable into a ladle of hot "ozite." If it "spits," there is moisture present, which will be further indicated by the formation of a brown froth. The writer has found this method to be always reliable. Care must be exercised not to have the ozite compound too hot, as will be described later. If moisture be present in one and not the other, the one showing moisture should be cut back a little at a time, until it becomes dry. If moisture is present in both, the splice should be located at the most convenient point, and resort be had to drying. To dry the cable, a torch is played upon the lead armor, beginning at the duct and slowly approaching the end, the torch being turned about the cable. The armor must not be allowed to heat sufficiently to soften.

After the cables "show dry," they are cut off the proper length. For single-conductor cables, a lap of about one inch or less is proper. For multiple-conductor, or "multiplex" cables, a considerable lap must be left to allow for staggering the conductor splices. About six inches from the central point of the splice, the lead armor is then scored circumferentially, care being exercised not to cut completely through. Some splicers perform this with a hammer and chipping knife, a practice to be strongly condemned, as the knife is liable to enter the interior insulator. The lead is then cut longitudinally by means of a hammer and chipping knife, the knife being so held as to enter the cable tangential to the interior insulation. The knife should be forced by slight taps of the hammer, heavy blows being avoided. The lead cover is then removed by bending outward with the plyers, beginning at the cable-end, and finishing by breaking at the circumferential cut. The end of the lead remaining on the cable is then belled out by means of a wooden stick or other blunt instrument, and the end carefully dressed smooth with a file. This leaves a final length of the completed splice of about twelve inches. For very heavy multiplex cables, this may be extended to eighteen inches.

In multiplex cables, the conductors are each separately insulated and the interior of the cable filled with some insulating filler. This filler is now cut through and removed to within about two or three inches of the end of the lead. During this operation extreme care must be exercised to prevent the knife from touching the insulation of the individual conductors. The exposed conductors are then laid together and the splices so planned that they will stagger.

While the splicer is engaged in the foregoing work, the helper, who is stationed at the top of the manhole, is heating the solder and ozite, and preparing the lead sleeve for covering the splice. These lead sleeves vary in size from 1 to 5 inches interior diameter, and from 6 to 24 inches in length. The sleeve is prepared by beating the ends down to a size just larger than the outside of the cable. This can be done by using a rawhide mallet or block of hard wood. Metallic hammers should never be used. The reduced ends are then scraped thoronghly, to a point well on the sleeve, and smeared with candle tallow, to prevent the formation of lead oxide. Two half-inch holes are drilled in the sleeve, one near each end, all edges carefully smoothed, and the sleeve is ready to be placed.

The splicer slips the lead sleeve over one cable and pushes it back out of the way, and the conductors are sleeved together and soldered. These copper sleeves should have a sectional area equal to the sectional area of the conductor, and the conductors should be carefully butted within the sleeve. After soldering, all points should be removed with a file. Neglect of this may cause a breakdown in high-tension cables, as it leaves discharge points for the escape of the current. The insulation of the conductor, if larger than the sleeve, is tapered down, and the joint carefully insulated with *pure rubber* tape. "Okonite" tape is not used for this purpose. The joints are then thoroughly dried out by pouring hot ozite over them, the ozite falling into a catch pan below the cable. The ozite should be hot enough to spit when moisture is introduced, but not hot enough to ignite a piece of paper. If too hot it may set fire to the cable and destroy the joint. This has frequently happened, and it is a point to be observed. Another precaution is in making the splice and in taping, so as not to bend the conductors sharply back out of the way, as it may result in injury to the cable at the points where the conductors enter the cable-filler. If necessary to bend the conductor, it should be a long radius bend, made by holding the conductor where it enters the filler.

Certain mannfacturers recommend the use of cotton tape, covered by a specially perforated paper or rubber bushing, in place of pure rubber tape, as an insulator for the conductor of joints. In some respects this method seems preferable, as it allows the hot ozite compound to flow directly to the joints, and insures proper spacing of the conductors. The writer is unacquainted with the practical application of this method.

After the conductors are given ample spacing, by bending slightly outward, the lead sleeve is slipped over the splice, the lead armor of the cable scraped clean and the sleeve wiped in place. It requires from 1 to 8 pounds of wiping lead for each splice, depending on the size of the cable. Hot ozite is then poured into one of the holes previously bored in the lead sleeve until it flows freely from the other. If moisture be present it will be indicated by a brown froth. The ozite should be allowed to flow until all this froth disappears. After about an hour's cooling the ozite will have shrunk, which necessitates the introduction of an additional amount. The previously mentioned precaution as to temperature of ozite should be always observed. The holes in the lead sleeve are soldered over, the cable carefully placed upon its supports and the splice is completed.

Important high-tension splices should not be made during rainstorms, and in no case should such a splice be left over night without being completed and sealed up. In going to and from manholes, cables should not be used as foot-rests. Steps should be provided.

NOTICE OF ERRATA.

In the article on "Relative Value of Coal and Oil as Used for Fuel," by R. F. Chevalier, page 286, May 2, 1908, "boiler" should be substituted for "brake" in the first and second lines of the second paragraph.

In the seventeenth line of the second column of the editorial on "Steam From Fuel Oil," "per barrel" instead of "per ton."

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EDITORIAL.

CONTROL OF PUBLIC UTILITIES.

Centralization of natural forces is necessary if they are to be used by a public whose civilization depends upon the minimizing of length, mass and time, and the voluntary regulation of the relative intensity of heat and light. This has been done by steam and electric transportation, gas and electric lighting, water-power utilization, and its transmission and distribution by electricity, which at present are largely under the organized direction of individuals. As a substitute for certain abuses of this private control, public ownership has proved partially successful but not wholly satisfactory. Hence, the alternative of public control of private ownership, which it is hoped will combine the advantages and eliminate the errors of both systems. Experience has shown that the best talent is attracted and works in a more efficient manner under private direction. Because of various motives, socialists and sentimentalists under the shrewd tutelage of astute politicians have been arrayed to destroy the big things builded by busy men with brave money. In the shadow of the mighty edifices reared by corporate power great evils undoubtedly do exist, but how much better is it to remove these worms that can live only in the dark, by means of the light of publicity, than to tear down meritorious institutions in whose shadow they crawl! Such light is far more effective than is heated argument, whose chief effect is to destroy confidence, the basis of all business.

But even this destructive force might be utilized if it possesses sufficient constructive power. The substitute proposed is excellent in theory, but so long as politicians see only additional patronage in municipal ownership, so long will its duties be performed by inferior men. Consequently, recognizing the limitations of human integrity and profiting by the experience of others, Massachusetts, New York and Wisconsin have provided public commissions to supervise private ownership.

The idea of a Public Service Commission is essentially that involved in many of the so-called bank and railroad commissions, but fraught with greater power for either good or evil, according to its personnel. For of greater importance than the laws defining its power are the men that compose it. They should be tried, technically trained men, who not only are faithful to the trust imposed in them by the public, but who realize the effect of their decisions on the practical operation of power, lighting and communication interests. Satisfaction can only be insured by fixed tenure of office, free from political direction and uninfluenced by local sentiment. There is not much difference between the fear inspired by a corrupt body and the dread caused by a well-meaning but an incompetent and inexperienced commission.

In its delicate function as the rider on the balance that weighs the relative value of the prices charged and the returns from capital invested, it should be borne in mind that its power is for regulation not operation. This policy which promises to replace the inadequate one of regulation by competition, will be operative only if it can provide proper protection for capital invested. The quasi-public corporations, in return for franchises and privileges granted, furnish the public a service which it needs, and they expect an ample return upon the investment commensurate with the risks assumed. If such is not provided, it amounts to confiscation. As the basis for figuring capital invested should be included not only the tangible property, but also the expenditure legitimately involved in perfecting the organization. This includes lawyers' expenses, the cost of bringing employees to the proper standard of efficiency, interest on the investment until the property is self-supporting, taxes and machinery repairs.

Its relation to the public it serves is simple but not less important than its stand toward the public-service corporation. Most people want good service, whether from hotel, railway, lighting, telephone or power companies, and do not much care as to the means by which it is accomplished. It should be the endeavor of any commission to force corporations to give the best service at the least cost allowable for fair profit over and above the operating expenses.

PERSONAL.

T. E. Bibbins left for the East on May 15th, to be gone for five weeks.

The Invincible Renovator Sales Company of California has offices at 950-954 Monadnock Building, San Francisco.

F. F. Barbour has been appointed assistant to the president of the Portland Railway Light and Power Co., at Portland, Oregon.

O. N. Lacey, secretary of the Hanford Mill & Electric Light Works, Hanford, Cal., was in San Francisco recently.

Frank S. Trumbull, of the Trumbull Electric Manufacturing Company, has been in San Francisco recently on business.

Elisha B. Seeley, general manager of the Couch & Seeley Co. of Boston, Mass., has been in San Francisco during the past week.

John F. Willard has been made manager of the Union Gas Engine Co., with offices and salesrooms at 503-505 Mission St., San Francisco.

M. J. Corwin, formerly engineer of the Farmers' Mutual Telephone Company, of Everett, Wash., has been appointed representative of the Dean Electric Company, of Elyria, Ohio, in the States of Oregon and Washington.

George Campbell, general manager of the Reno Power, Light & Water Company and the Reno Traction Company, has been in San Francisco to consult the directors with regard to the extension of the street car line in Reno.

TRADE CATALOGUES.

"Magic Methods" from H. W. Johns-Manville Co., 100 William St., New York City, tells how Magic Boiler Compound eliminates boiler troubles, such as scale, pitting, corrosion and leaking. It "acts on the iron—not on the water."

MEETING NOTICE.

The Technical Publicity Association at its annual meeting, April 30, 1908, elected the following officers to serve during the ensuing year: President, C. S. Redfield, advertising manager Yale & Towne Manufacturing Company, New York; first vice-president, Rodman Gilder, publicity manager Crocker-Wheeler Co., Ampere, N. J.; second vice-president, C. N. Manfred, manager advertising department H. W. Johns-Manville Co., N. Y.; secretary, H. H. Kress, publicity department A. S. Cameron Steam Pump Works, New York; treasurer, H. M. Davis, advertising manager Sprague Electric Company, New York; members of executive committee: F. H. Gale, charge of advertising of General Electric Company, Schenectady, N. Y., and C. W. Beaver, special representative Yale & Towne Manufacturing Company, New York. Twenty new members have joined the association since the last annual meeting.

WARNING.

A man giving his name as George Williams, and stating that he is connected with the Brenham-Compress Oil & Manufacturing Company, Brenham, Texas, has approached several electrical companies, including some dealers in Buffalo, with the evident intention of defrauding them. One of his methods has been to place a substantial order for electrical material, with which he seems to be thoroughly familiar, and after offering checks and referring to his credit with Texas banks, he attempts to borrow money. Subsequently it has turned out that his checks offered in payment are not covered by the local banks in which he claimed he had deposited, or would deposit, money to cover his purchases. The man did not deposit the funds as promised, and used the receipt for the checks in an attempt to secure more material from another dealer. This man is described as about five feet nine, stocky build, weighing about 170 pounds; has light hair, blue eyes, smooth face; large, rough, weather-beaten features; upper front tooth broken or missing; wore a soft hat and dressed in general Western style.

GENERAL ELECTRIC ANNUAL REPORT.

The sixteenth annual report to the stockholders of the General Electric Company, covering the year ending January 31st, 1908, shows that the profits, after deducting all patent, general and miscellaneous expenses, and allowances for depreciation and losses, and writing off $3,745,989.06 from factory plants, were $6,586,653.37; paid in dividends during the year, $5,183,614; carried to surplus account, $1,403,039.37; surplus at the end of last fiscal year, $15,110,796.77; total surplus January 31st, 1908, $16,513,836.14.

Late in the year there was a sudden and severe shrinkage in the value of all merchandise and materials used by the company, notably copper. All said materials, whether raw, manufactured, or in process of manufacture, which were on hand January 31st, 1908, were inventoried at the lower prices then prevailing. The book value of such inventories was thereby reduced by about $2,000,000.

In valuing the notes and accounts receivable, in amount the largest in the company's history, great care has been exercised and liberal reserves have been established to provide for possible losses thereon. These reserves and allowances for depreciation of factory plants and the shrinkage in inventory values have greatly reduced the profits. As a result, the amount in excess of dividends upon its share capital, which is carried forward to surplus account is relatively small. During the year all the assets and liabilities of the Stanley G. I. Electric Manufacturing Company, Pittsfield, Massachusetts, were taken over, and the factories owned by that company at Pittsfield are now a part of the factory plants of the General Electric Company. In this practical liquidation of the Stanley Company there has been a considerable shrinkage in the valuation of its factory properties, inventories, and other assets, thus adding to the otherwise large depletion in the profits for the year.

The unencumbered fee of about 700 acres of land adjacent to the city of Erie, Pa., was purchased at a cost, including engineering and other expenses, of $232,301.53. In view of the existing depression, the erection of buildings thereon is deferred for the present. The various securities included in the stocks and bonds account have been carefully re-valued, item by item, with the result that the book value thereof has been fixed at $18,000,089.85.

The report upon sales presented by Vice-President J. J. Lovejoy shows total sales billed of $70,977,168, and total orders received of $59,301,040.

In the ten-year period ending January 31, 1908, sales billed have increased from $12,396,093 to $70,977,168, an average increase of 19.8% per year. Sales billed during the year 1907 increased 18.2 per cent over the previous year. Orders received during the first six months of the fiscal year, February 1 to July 31, 1907, increased 22 per cent over the corresponding period of the year 1906. Owing, however, to the disturbed financial conditions prevailing during the latter part of the year, orders received for the second six months of the fiscal year decreased 23 per cent as compared with the previous year. Since November last there has been a heavy decrease of orders received as compared with the past three years. The total number of separate orders and contracts received during the year was 237,006, an average per week of 4,558.

Among many important orders received during the year are:

Great Western Power Company, San Francisco, Cal., three water wheel generators, 10,000 kilowatts each, together with the necessary transformers and other electrical apparatus for transmitting current at 100,000 volts from its power house on the Feather River to Oakland, Cal., a distance of about 165 miles.

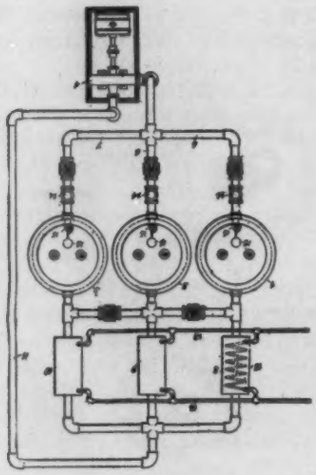
The Central Colorado Power Company, Colorado Springs, Colo., four 5,000-kilowatt generators and other electrical apparatus for water-power development at Glenwood Springs,

(Continued on page 311.)

PATENTS

COOLING SYSTEM FOR ELECTRIC APPARATUS. 886,073. Karl C. Randall, Edgewood Park, and Charles B. Gibson, Wilkinsburg, Pa., assignors to Westinghouse Electric & Manufacturing Company.

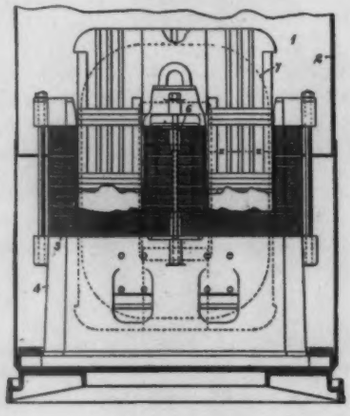
The combination with a plurality of electric transformers,



fluid-containing tubes therefor, cooling chambers and means for maintaining a circulation of insulating fluid through the tanks and the chambers, a throttle valve in the supply line of each tank and means for automically controlling the throttle valve.

TRANSFORMER COIL INSULATION. 885,771. Jesse E. Mateer, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.

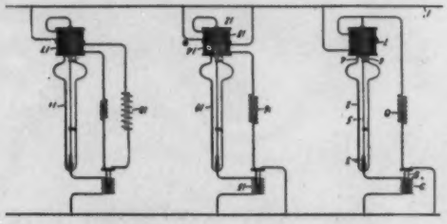
A transformer coil having spaced insulating strips at its



sides, insulating channel pieces fitted over its edges, angle pieces fitted over the channel pieces, and barrier plates extending along the sides of the coil in contact with said strips and angle pieces to form an inclosing casing.

STARTING DEVICE FOR MERCURY-LAMPS. 885,882. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company.

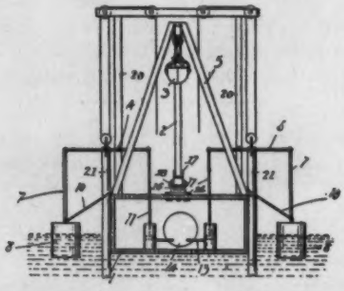
In an electrical system, the combination of a vapor electric device having an initially conductive path of high resistance



therein, means for supplying current therethrough, a movable member to start an arc in said device, electro-magnetic means traversed by said current and disposed for operating said movable member, and means for abnormally increasing the effectiveness of said electro-magnetic means at starting.

MEANS FOR UTILIZING WASTE POWER IN DREDGES. 885,900. Robert M. Wilson, San Francisco, Cal.

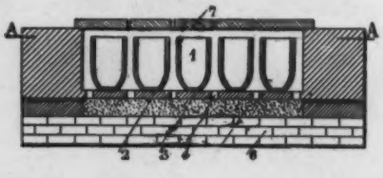
In an apparatus of the character described, the combination with the hull of a dredger, and a boom thereon adapted to swing



to a side of the dredger, and means for carrying a load at the end of said boom, a device supported at the side of the dredger independently thereof, and means carried by the dredger and movable therewith as it rocks transversely with the swinging movement of the boom, said means co-acting with said device to generate power.

ELECTRIC FURNACE. 885,745. Paul Girod, Ugine, France.

In an electric furnace, the combination, with a receptacle forming a chamber arranged to receive a plurality of objects to be heated and provided with end extensions, of insulating

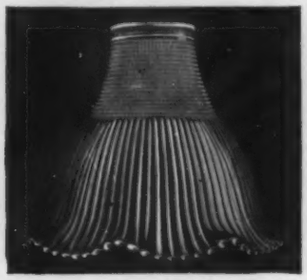


masonry inclosing said receptacle and arranged to support said extensions, a mass of resistance material between the receptacle and the masonry pole pieces extending through the masonry and arranged to conduct current to the resistance material.

INDUSTRIAL

ATTRACTIVE NEW HOLOPHANES.

The demand upon the part of illuminating engineers, and others having to plan or specify lighting installations, for reflectors of more attractive designs than those ordinarily procurable, yet of such efficiency as shall commend them, has led the Holophane Company to design and offer a new series of reflectors similar to their popular No. 4526. These reflectors, here illustrated, are numbers 2679, 45186, 4526, 4576, and 4676.



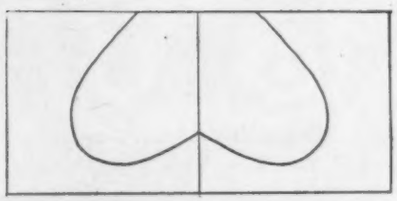
No. 7629

No. 4526

No. 4576

No. 4676

No. 4516



CHARACTERISTIC CURVE OF HOLOPHANE FRENCH SHAPED REFLECTORS.

This design is very distinctive, being based upon the French shape originally brought out abroad. The ready sale of this series of reflectors in European markets, and the wide variety of applications to which they may be put, make them a welcome addition to the Holophane line.

The characteristic distribution of light obtained from the use of these reflectors is shown herewith. While the several designs vary somewhat in results given, this curve will serve as a general guide to the series. These reflectors are particularly recommended for use in connection with the smaller frosted tip tungsten lamps, as they completely protect the eye from the intense rays of the light.

GENERAL ELECTRIC ANNUAL REPORT.

(Continued from page 309.)

on the Grand River, the electrical energy to be transmitted throughout the central portion of the State for mining, general power, lighting, and railway service.

The Detroit River Tunnel Company, a subsidiary of the Michigan Central Railway Company, apparatus for equipment of the Detroit Tunnel under the St. Clair River. The contract includes several 1,000-kilowatt motor-generator sets, with accessories, and six 100-ton locomotives, each equipped with four 250-horsepower motors.

The Great Northern Railway, for electrification of the Cascade Tunnel, water-wheel generators and 100-ton locomotives, each equipped with four 250-horsepower alternating-current motors, giving a continuous output of 1,000 horsepower per locomotive.

The Southern Pacific Railroad, for electrification of its suburban lines in Oakland and Alameda, Cal., forty-four four-motor equipments with Sprague-General Electric control. The motors are 125 horsepower each.

The Hudson Tunnels Company, the turbine-generators, rotary converters, motors, and controlling apparatus for complete electrical equipment of its system of tunnels under the Hudson River connecting New Jersey and Manhattan. A portion of this system was put into successful operation on February 25th, 1908, and regular service is now maintained between Nineteenth Street (Sixth Avenue), New York City, and Hoboken, N. J.

The West Jersey & Sea Shore R. R. Co., a branch line of the Pennsylvania Railway running from Camden to Atlantic City, mentioned in last year's report, has maintained its record of satisfactory operation, and orders for additional equipment have been received during the past year to provide for the increased traffic.

The New York Central and Hudson R. R. Co. is now operating in its New York City Terminal thirty-five electric locomotives of their manufacture, each equipped with four 550 horse-power direct current motors. Twelve additional locomotives have recently been ordered, making a total of forty-seven locomotives purchased from them by this company.

The use of electrical apparatus for industrial purposes is extending rapidly, and large purchases of their apparatus have been made during the year for completely equipping mills with turbine and engine driven generators for lighting and power, and with motors of standard and special design for driving machinery of every description.

Orders for supplies, such as meters, transformers, arc lamps, winding devices, electric heating devices, repair parts of electrical apparatus, etc., show an increase over last year. The list of supplies comprises upwards of 50,000 items, separately catalogued and priced. In addition to the large stock of finished product carried at the several points of manufacture, they maintain fourteen warehouses in various cities, from which shipments to the value of over $6,000,000 were made during the year.

To meet the requirements of interurban railways where a potential higher than 600 volts is desirable and the conditions are unfavorable to the adoption of the single phase alternating current system, they have developed a high voltage direct current railway system to operate at 1200 volts. Two roads have been operating under this system for several months with entire success. Equipment for several additional roads of this character is in process of installation.

The Curtis steam turbine continues to give excellent service, and the confidence of users is evidenced by numerous additional orders for existing installations. The total number of Curtis turbines shipped to date is 960, having a total capacity of 1,086,000 horse-power. Orders were received during the year for turbines aggregating 380,000 horsepower. They now have in process of manufacture for the Commonwealth Edison Company of Chicago, and the New York Edison Company, a large number of turbine-generators of 14,000 kilowatt capacity each, which will be the largest steam driven electrical units ever produced.

The consumption of carbon filament lamps has steadily increased during the year, and with their enlarged capacity they are prepared to take care of the demand. In addition they have received large orders for different types of high efficiency metal filament lamps, first consideration being given to such sizes and types as will aid central lighting stations in providing for the requirements of their customers and the extension of their business.

The report of Vice-President E. W. Rice, Jr., upon Manufacturing and Engineering, shows that expenditures aggregating $6,350,576.74 have been made during the year for real estate, erection of new factory buildings, extensions to existing buildings, additional machinery, patterns, special tools, fixtures, etc. The increase in expenditures mentioned above over previous years is due to including the expenditures made during the year upon the Pittsfield plant, and to the urgent demand for largely increased manufacturing facilities to properly care for their business, which rose from $40,000,000 for the year ending January 31, 1904, to $60,000,000 for the year ending January 31, 1907, and culminated in an annual rate of $75,000,000 during the first quarter of the fiscal year just ended. The unfilled orders as of January 31, 1907, had also reached $28,000,000, and deliveries were generally unsatisfactory. Since the beginning of the business depression, expenditures for plants have been limited to those needed to complete extensions already far advanced, or to those which were clearly necessary for reasons of economy or maintenance of equipment and buildings.

During the first part of the last year their engineers were fully occupied in supervising the technical details of their greatly expanded business. Upon the decline in business which followed, they have had more time to devote to improvements and economies in design of their apparatus. More attention has also been given to the design of special apparatus intended to meet novel conditions, and to the extension of their business along profitable lines.

The apparatus designed by their engineers for the long distance transmission of electricity has proved most reliable, economical and satisfactory in operation.

There has been a continued increase in the capacity of electric generators and transformers.

Their high tension switching apparatus has been still further improved, and they have been favored with the most important orders for such installations.

The details of the steam turbine-generators have been improved, great economy and proved reliability are now assured, and the turbine-generator is now standard for all new important electrical installations where steam is utilized. They are now building turbine units of a capacity of 14,000 kilowatts; the largest electrical generating units ever produced. The Commonwealth Edison Company, of Chicago, has now in operation in one station nine large turbines capable of generating a total of 103,500 kilowatts.

Their engineers have devoted considerable attention to the design of a line of turbine-generators for use with exhaust steam. Such steam turbines are so much more efficient than steam engines when operated by low pressure steam, that they can be most usefully employed to supplement steam engines in existing installations. Their use will result in large increases in output without any increase in coal consumption.

Their single phase alternating current railway equipments have been greatly improved during the last year.

Their new direct current railway motor, mentioned in the last report, has proved so satisfactory in practical operation that it is rapidly being adopted as the standard type. It marks an important advance in economy and durability.

They have extended the range of economical operation of direct current railway apparatus by designing it for use at 1200 volts, about double the existing standard, and have sold a number of such equipments to the Southern Pacific R. R. Company.

They have sold to the Great Northern R. R. Co., four 100 ton, three phase electrical locomotives, designed to handle all trains traversing the two and one-half miles of Cascade tunnel in Washington. This installation will be especially notable as the first instance of the substitution of electricity for steam on a mountain division of one of the Continental railways. The traffic conditions are peculiarly difficult on account of the grades and tunnels. These electric locomotives, because of their increased speed and better control, will practically double the traffic capacity of the present steam locomotives. Electricity for their operation will be supplied from water power hitherto unused.

A gas-electric car which fully meets the requirements of steam railroad companies for service on branch lines has been perfected. The equipment consists of a gasoline engine driving an electric generator which furnishes current to standard railway motors. The engine and generator are located in the forward end of an especially designed car, conveniently divided into passenger and baggage compartments, making a complete self-contained unit.

They have made many valuable improvements in the design of machinery for electric reduction of metals and in apparatus for various industrial applications.

They have shipped several large motors of special design of about 10,000 horse-power capacity each for driving rolling mills, and have received orders for additional equipments.

Important improvements in the design of their lines of wiring devices, rheostats, circuit breakers, switches, instruments, and other small devices, have been made during the year.

Their new tungsten incandescent lamp, which gives more than double the illumination of the carbon filament for the same expenditure of power, has been further developed and has now become a standard commercial article.

Several novel types of arc lamps of greatly improved economy have also been perfected and sold in large quantities.

OTIS & SQUIRES.

W. I. Otis and H. B. Squires, formerly with the California Electrical Works have opened offices at 111 New Montgomery St., San Francisco, as agents for the Columbia Incandescent Lamp Co. of St. Louis, and Machado & Roller of New York, whose line includes the Whitney Instruments, S. E. Circuit Breaker and Hartman & Brown instruments. This new firm is warmly welcomed among the local jobbers.

NEWS NOTES

OIL.

San Luis Obispo.—Advices state that the big refinery at Oilport is to be reopened for business on July 1st. Ever since the loss of the wharf during the heavy seas of last winter, the company has had its plant closed down.

San Luis Obispo.—It is reported that the Union Oil Company will construct a big refinery at Avila. Credence is given the report by the fact that the Lacey Manufacturing Company has just completed the construction of a 55,000-barrel storage tank at Avila.

San Francisco.—In April a cargo of refined petroleum was sent from this port to Manila by the British ship "Jute-opolis," the quantity being 120,650 cases, or 1,206,500 gallons, and valued at $96,520. There were also 107,000 barrels, or 4,484,000 gallons, of crude oil shipped during the same month.

Los Angeles.—In the Sunset-Midway fields the extensive new development work of Kern County is being rushed to the full extent. In the Sunset field proper there is very little new work. Around the town of Maricopa a great deal of work is going on, the Fulton Oil Company having one crew at work on a new well and derricks up for two more.

Los Angeles.—The Union Oil Company is about to ship 25,000 barrels of crude fuel oil from San Pedro to Guatemala for use in the locomotives of the railroad that crosses Central America. The fuel for this line has been going from California through the Union Company for the past year or more, but this is the first shipment from San Pedro. The oil will come from Los Angeles and Orange County districts, which a year ago, or a little more, were unable to supply the home demand.

Bakersfield.—The Associated Oil Company is taking every barrel produced in McKittrick, and it all goes to the Southern Pacific, not a barrel of commercial oil going out at this time. Sixty cents is the ruling price for new contracts, and 50 cents is paid for daily runs, while there are a few old contracts still in force at lower figures. The Standard offers but 50 cents and is making no effort to get contracts. No oil has been run through the newly completed pipe that connects with the Bakersfield-Point Richmond line. The total shipments are around 7,000 barrels a day.

Bakersfield.—According to a so far unverified report, the Standard has purchased the lease of the Talara Oil Company on the west half of the southwest quarter, section 24, at Midway. The sale, if it has been made, has been carried out very quietly indeed, even for a Standard transaction. The Talara is controlled by W. S. Porter and O. Scribner, general manager and assistant general manager of the Associated Company, respectively. Its oil has been going to the Standard for some time past. The land is owned by J. W. Jameson. Colonel Babcock, of Titusville, Pa., is reported to have bought the lease of the Josephine, owned chiefly by John Connolly, of Midway, on the southeast quarter of section 23, which immediately adjoins the Talara, for $250,000. This is not yet confirmed. The Standard has attempted to buy other lands in Midway, and has been reported to be desirous of buying holdings from the Section Twenty-five Company, also those of the Mount Diablo. The last named has just brought in a new well at 1,000 feet.

TRANSMISSION.

Downieville.—The Plumbago Mining Company is arranging to move its power plant up to the mine, and after this has been accomplished, heavier machinery will be installed.

Rawhide, Nev.—R. O. Bioli, general superintendent of the Truckee Electric Power Company, with headquarters at Reno, is in camp at Rawhide to look over the situation relative to installing a branch of his company.

Los Angeles.—The power station at Holtville on the Alamo River is to receive extensive improvements, and an additional turbine and generator will be installed so as to increase the plant's capacity by 1,000 horsepower.

Independence.—The Four Metals Mining Company is repairing the road through Lone Pine Canyon of the Alabamas, preparatory to the construction of an electric power plant at the foot of the Sierras as soon as a permit can be obtained from the Forest Service.

Redding.—The Battle Creek Power Company, which is subsidiary to the Northern California Power Company, has given notice that it will appeal from the decision rendered recently in the Superior Court, wherein the Pacific Power Company and others were awarded $32,000 damages for land condemned on Battle Creek.

Placerville.—Otis Gibson has filed notice of location and appropriation of 20,000 inches of water of Rubicon River, to be used for irrigation, mining, municipal, domestic, mechanical, and electrical purposes. A power-house site near the junction with Pilot Creek is to be determined by later survey. Notice has also been filed on 5,000 inches of the water of Little South Fork of the Rubicon River to be diverted to Pilot Creek by ditch.

Berkeley.—Application has been made at the office of the building inspector for a permit to construct a concrete power transformer station on the ridge just back of the Spring Construction Company's quarry at the point where the Bay Counties Power Company's wires are brought into town on their way to Oakland. This power transformer station will prepare the electric current for transmission on small feed wires direct to the towns and communities where the current is sold. The permit was applied for by the Pacific Gas & Electric Company of San Francisco, a corporation allied with the Bay Counties Company. The constructing engineer is H. C. Vensano. The power station is to be 55x53 feet in dimensions and will cost $12,000, exclusive of the machinery that is to be installed.

TELEPHONE AND TELEGRAPH.

Honolulu.—There was a meeting recently of the Wireless Telegraph Company, at which it was unanimously decided by the stockholders that the plant and station at Kahuku should at once be commenced. Arthur A. Isbell, the expert who came down to make tests with a view to locating the proper site for the station, and who selected Kahuku, the site that was originally selected by Captain Niblack for the navy, but abandoned owing to the fact that there would be no guns there to protect it, was chosen as superintendent of construction to take charge of the installation of the plant and the erection of the station at Kahuku.

POWER AND LIGHT.

Spokane, Wash.—George Nixon, of the firm of Nixon & Kimmel, of Spokane, has been awarded a franchise by the Commissioners of Spokane County for the installation of a power plant to furnish heat, power and electric lights for the towns of Deer Park, Chattaroy and Milan. The line will be twenty-five miles in length. Mr. Nixon says he is able to develop all the power needed by a waterpower plant to be established on his property, one side of which is bounded by the Spokane River, near Deer Park.

Santa Rosa.—The contract has been let for the carrying out of one of the biggest electrical projects in Northern California, namely, the construction of a power line from the great generating plant of the Snow Mountain Power and Water Company, on Eel River, Mendocino County, through Ukiah, Hopland, Cloverdale, Healdsburg, Windsor, Santa Rosa, and on to Petaluma. The line has already been built as far as Talmage, two miles from Ukiah, and the poles and wire are already on the ground for carrying on the construction. It will be a big enterprise, and it is predicted that it will mean a big reduction in rates for power and light when the current is turned on.

Spokane, Wash.—One million dollars is the stated capital of the Northwest Light & Water Company, with headquarters at Carson City, Nev., which filed its articles of incorporation at Wallace, Ida., a few days ago. The incorporators are Robert E. Strahorn, of Spokane, president of the North Coast Railway Company; A. G. Smith, R. J. Danson and E. D. Doyle. It is generally believed at Wallace and Spokane that the light and water plants at North Yakima, Wash., Wallace., Ida., and Sumpter, Ore., will be consolidated. The owners of the Wallace plant are known to control the others mentioned, and it is believed that the filing of the articles of the Northwest Light & Water Company is simply an initial step toward the merging of these interests.

Spokane, Wash.—William T. Clark, of Spokane, president of the Wenatchee Canal Company, operating in the Wenatchee Valley, west of Spokane, and his associates composing the Valley Power Company, have ordered machinery for a $100,000 plant on the Wenatchee River, five miles above Cashmere, Wash. Four thousand horse-power will be developed, the plant to be in operation next fall. The company will furnish power to ranchers to secure water for irrigation. The Wenatchee Canal Company will use some of the power in boring a hole through Shotwell Hill, to do away with expensive fluming, and run the water through the hill. The company has undertaken the irrigation of several thousand acres of land.

Spokane, Wash.—The power plant to be constructed by a Portland syndicate on the Snake River will be at least 60,000 horse-power. When work on the plant was begun it was believed that at the lowest stage of the river only 36,000 theoretical horsepower could be developed, but daily gauges of the lowest stages of the stream show that at least 90,000 horsepower can be generated at the lowest stages of the river. Present plans call for a transmission system extending 350 miles, with numerous sub-stations in various directions from the main plant. Power will be furnished to the Seven Devils district, and to mines in Eastern Oregon. Twelve thousand poles for carrying the wires are now on the ground. The engineers are boring for a rock foundation for the dam on the Snake River, where the power is to be generated.

Spokane, Wash.—The Washington Power Company is negotiating for the overflow privileges on 6,000 acres of lowlands in the Coeur d'Alene Indian Reservation on the St. Joe and St. Maries Rivers in Northern Idaho. Surveyors have been working along these rivers since the first of the year, and the preliminary survey is nearly completed. The overflow of these lands is occasioned by the dam at Post Falls, Idaho, where one of the big lighting plants is now in operation. The level of the Coeur d'Alene Lake has been raised three feet above normal stage by the dam, and the backwater thus occasioned has covered thousands of acres along the Coeur d'Alene, St. Joe and St. Maries Rivers. Arrangements have been made with the settlers along the Coeur d'Alene River for the purchase of land thus affected by the backwater. Options covering nearly all of this land have been secured by the company, and many of them taken up. In numerous instances easement for overflow only is secured, while in others, the company purchases the land direct.

ELECTRIC RAILWAYS.

Yakima, Wash.—A. J. Splawn, president of the Yakima Transportation Company, states that his company has secured rights of way for nearly all of its proposed lines in the Yakima Valley, west of Spokane. The company expects to float $2,000,000 bonds so that work on the lines to Sunnyside, the Moxee and the Ahtanum may be constructed at about the same time. The branch to Cowiche, to serve ranchers on the Tiston irrigation project, probably will not be started until the district is opened. Cars will be in operation at North Yakima in September.

Spokane, Wash.—Frank McLean, engineer in charge of the Oregon & Washington Electric Railway Company, has filed on a 12,000-horse-power water right along the line of the proposed road to Lewiston, Ida., to Pomeroy, Wash. Contractors have been on the ground figuring for bids on the construction of the first ten miles of the road. The water rights were filed on under the name of the North Coast Power Company. This has led many to conclude that the electric road is a part of the line of the North Coast Railway Company, and that the division from Wallula to Lewiston is to be operated by taking advantage of the numerous creeks along the right of way.

Spokane, Wash.—Official announcement is made that the Snohomish Valley Railroad has been successfully financed in London, and that actual construction work on the first fifteen miles of the line will begin at once. This company was organized several years ago to build a line from Snohomish to Cherry Valley, but finding its proposition too small to interest the financiers of the East, it reorganized for the purpose of building a line to Renton, and from that point run lines to Seattle and Tacoma. The company is incorporated for $2,500,000, and has authorized a bonded indebtedness of like amount. The company has $500,000 in hand to begin operations.

Spokane, Wash.—Jay P. Graves, president of the Spokane & Inland Empire Electric Railway Company, has applied to the City Council of Spokane for a franchise for the construction of a line in Mendenhall Avenue, the continuation of East Riverside from Madelia Street and Olive Avenue to Sprague Avenue and Freya St, about two miles. This will give direct service to the Spokane Interstate Fair Association's grounds, four miles east of the heart of the business district. The Washington Water Power Company's tracks run on Sprague Avenue as far east as Lacey Street. They are one block distant from the south entrance of the fairgrounds. The traction line will cut in between this line and the grounds, and will deposit its passengers almost at the entrance. East Sprague avenue is the most traveled thoroughfare in the eastern part of the city, and a franchise for a street car line on it would be of more value than on any parallel avenue. It will be the first street car service extended to the district which was annexed last November. The ordinance requires that work shall begin within sixty days of the passage of the measure, and the line is to be in operation within a year.

POWER AND LIGHT.

Washougal, Wash.—C. L. Prichard has been granted a franchise for lighting the city.

Lewiston, Ida.—The ordinance granting to the North Coast Power Company the lease of a tract of land near the pumping station for the site of a power plant was passed.

Valdez, Alaska.—The Alaska Water, Light & Telephone Co. will spend $10,000 to $15,000 during the coming summer constructing dams and reservoirs for power purposes.

Hailey, Ida.—H. J. Allen has sent up a crew of five linemen to set up the poles and string the wires for his light and power plant from Trail Creek to the Independence mines.

Cottage Grove, Ore.—W. W. Oglesby has located a water right on Row river for what is to be known as the Cottage Grove Power & Electrical Canal. He appropriates 500,000 miners' inches of the water from that stream.

Pocatello, Ida.—The principal stockholders of the Bear Lake Electric Co. have decided to go ahead with improvements to the system. A new power house will be built and the power of Paris creek developed to full capacity.

Spokane.—George Nixon of the firm of Nixon & Kimmel of Spokane was awarded a franchise by the county commissioners for the installation of a power plant with which to furnish heat, power and electric lights for the towns of Deer Park, Chattaroy and Milan.

Wenatchee, Wash.—A franchise was granted to the Entiat Power Company containing the stipulation that the company should put up the sum of $850 in cash to insure good faith and to insure the delivery of electric power for heating and lighting into this city by November 1, 1909.

New Westminister, B. C.—The British Columbia Wood, Pulp & Paper Company of Vancouver has posted an application in Water Commissioner Fisher's office here for a record of 20,000 inches of water from the Cowholm river on Howe sound. The water will be used for the purpose of generating power to operate its pulp and paper mill.

Nelson, B. C.—Fire recently destroyed the substation of the West Kootenai Power & Light Company and the Municipal Power Plant Company jointly. The loss is estimated at $50,000. The Electric Tramway Company's plant, leased by the city, was entirely destroyed. The transformers of the West Kootenai Power & Light Company were also destroyed, as was also the switchboard belonging to the city.

GAS.

Los Angeles.—Robert Weiss has been granted a franchise to lay gas pipes in the streets of Ontario.

Azusa.—The Interstate Gas Co. is making extensive improvements in the Covina plant, and have installed a purifier capable of handling sufficient gas to supply a city of 10,000 people. New and larger pipes are also being laid, and it is the purpose of this company to give the people of this valley one of the best gas systems to be found anywhere. Vice-president J. V. Hoffman was in Azusa last week, and announces that the company will soon place $30,000 worth of 10-year, 6 per cent bonds on the market in denominations of $500 each. These bonds will be sold at par and the money will be used to lay the pipe for the Azusa-Glendora division. The officers of the company assure the public that the entire valley will be piped soon, whether the bonds are sold or not, but inasmuch as these bonds participate in the earnings of an established plant, it is believed the people of the valley will consider them a favorable investment.

TELEPHONES.

Grangeville, Ida.—A franchise was granted the Whitebird and Doumecq Mutual Telephone Company.

Grangeville, Ida.—A franchise was granted the Farmers' Telephone Line No. 15 to construct a line along the public road.

Grangeville, Ida.—A franchise was granted the Whitebird and Pittsburg Mutual Telephone Company to erect a phone line along the public road.

Cashmere, Wash.—Construction work by the Farmer's Telephone and Telegraph company began recently and will continue for several weeks. The entire system is being overhauled.

Montesano, Wash.—At a recent meeting of the city council a franchise was granted to C. H. Wolf & Co., which has taken over the lines and instruments of the Pacific States Telephone Company in the local field.

Montesano, Wash.—At a recent meeting of the city council a franchise was granted to C. H. Wolf & Company, which has taken over the lines and instruments of the Pacific States Telephone Company in the local field.

Baker, Wash.—The business men in this locality have organized a telegraph and telephone company under the name of the Skagit River Telegraph & Telephone Co., capitalized for $5,000, and will run a line from Concrete to Sedro-Woolley, working having been started. The officers are R. J. Kellogg, president and treasurer; E. C. Miller, vice-president, and J. K. Merz, secretary.

Spokane.—Construction will begin in a few days on a new telephone system at Fort Wright, which will provide 40 more instruments connected with the post exchange. Four trunk lines instead of one will give connections with the city. The telephone instruments provided by the government will be discarded and Pacific States Telephone Company telephones put in. A new and more modern switchboard will be installed in the headquarters building.

Bellingham.—Early in June Bellingham will have telephonic connection with Seattle, Tacoma and other cities of the Northwest, on two wires of the Home Telephone Company. The company has wires as far north as Mount Vernon. Poles have been put in as far as Bellville and in about a week two crews of men will be put to work between this town and Bellingham, one crew working north, the other south. The entire cost of the line will be about $50,000. The company will also do extensive work in Bellingham, enlarging its system to meet the demands of business.

INCORPORATIONS.

Fresno.—The Bishop Oil Company has been incorporated with a capital stock of $300,000 by C. A. M. Swain, W. G. Cochrane, L. A. Teague, E. R. and Ralph Bishop.

San Jose—Articles of incorporation have been filed by the Alviso Electric Light & Power Company, which was incorporated by G. L. Donovan, J. N. Thane, J. A. Belloli, Jr., Theo. Belloli, and L. E. Munier. The capital stock is $100,000.

Bakersfield.—Articles of incorporation have been filed by the Fresno Midway Land and Oil Company, with a capital stock of $25,000. The directors are L. Samuel, H. E. Barnum, E. J. Boust, H. C. McKamy, and S. L. Hogue, all of Fresno.

Port Angeles, Wash.—The franchise asked by the Port Angeles Railway & Terminal Company was granted by the city last week, but was amended in some minor particulars, but grants practically all that was asked by the new railroad company, which is believed to be controlled by the Chicago, Milwaukee and St. Paul.

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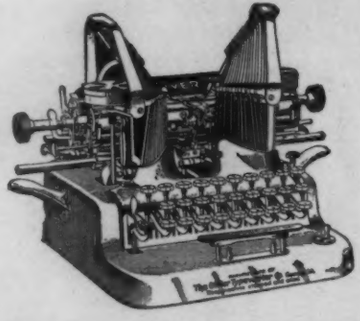

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